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CHEMICAL & ENGINEERING

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Preserving the Past

Chemistry helps conserve museum objects Page 10

CHEMICAL & ENGINEERING
NEWS
NOVEMBER 14, 1988

Volume 66, Number 46
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News of the Week

■ **Quantum chemist William A. Goddard III is under attack for a theory of high-temperature superconductivity being developed by his group.** **Page 6**

■ **Just one week after closing down its rayon manufacturing facility, in Front Royal, Va., Avtex Fibers has restored the plant to full operation.** **Page 7**

■ **Texas has been selected as the site for the Superconducting Super Collider.** **Page 7**

■ **President-elect George Bush says he intends to raise the status of science adviser to Assistant to the President.** **Page 7**

■ **Computer virus attack on research network sparks consideration of added measures needed to prevent future incursions.** **Page 8**

■ **Du Pont has proposed a joint venture to commercialize high-tech food products.** **Page 8**

Cover: Stern of 17th century Swedish ship *Wasa* at museum in Stockholm. Photo by Curtiss E. Peterson

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Business

Banner performance of major U.S. chemical companies continued into the third quarter, with earnings soaring 65%; Henkel has realigned its metal treatment business to gain edge in global market; Ireland anticipates major benefits from 1992 European Community plan to eliminate trade barriers. **Page 24**

Government

Many universities are putting off repairs of research facilities because of problems in obtaining funding for renovation, NSF survey finds; Biotechnology Institute may be formed to provide technical and legal training for biotech patent examiners. **Page 42**

Science

Chemistry of cubane enters new era, with development of procedures that have opened the way for synthesis of new cubane derivatives; oligonucleotide probe that cleaves phage DNA site-specifically holds promise for genome mapping; CHEMRAWN II is still at work, six years after it convened. **Page 45**

Books

"Stones in a Glass House" and "Saving Our Skins" delve into the threat of chlorofluorocarbons to Earth's atmosphere. **Page 59**

Awards

ACS award winners: Enke, Henis, Hubbard, Kanigel, Kirchner, Bowers, Klibanov, Knight, and Knowles. **Page 65**

News Focus

Chemical methods are helping scientists to restore and conserve important historical and archeological relics. **Page 10**

Chemical & Engineering News

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LETTERS

Contributions of chemists

SIR: The report of Geoffrey Cantor's comments regarding British Prime Minister Margaret Thatcher's selection of Michael Faraday as her historical hero is an interesting observation (C&EN, Aug. 22, page 92).

It should be noted, however, that it is to Thatcher's credit that she did not let the political views of Faraday overshadow her great appreciation of his remarkable contributions to both chemistry and physics.

It is encouraging to note that although as Prime Minister she has turned her major attention to public affairs, she is not unaware of the importance of scientists in history.

In this connection the Beckman Center for the History of Chemistry is to be congratulated on bringing to public attention the past contributions of chemists. Unfortunately, entirely too many chemists know very little about the work of those who have made the science of chemistry what it is today.

William J. Burke
Tempe, Ariz.

Interest in secretariats

SIR: The ACS Focus on divisions (C&EN, Aug. 29, page 40) ignored several facts that bear on the role and the vitality of divisions in ACS as follows:

- In addition to 32 divisions, there are 11 subdivisions or one third again as many additional area-focused programming entities in ACS, for a total of 43. Presumably more are yet to come.
- In apposition to that fragmentation there exist several secretariats that serve as "lintels across the columns." The first such was the Macromolecular Secretariat, formed many years ago, followed by the Computer Secretariat in the late 1970s. Recently there has been a spate of secretariats: biotechnology several years ago, catalysis just recently, and now we have a movement afoot to create a Material Chemistry Secretariat. Secretariats are not explicitly called out anywhere in the ACS constitution or bylaws, but are formed under a variety of agreements—even just oral—among participating divisions.
- There is a Divisional Officers Caucus—another ad-hoc organization with no explicit mention in the ACS constitution or bylaws—that complements the Committee on Divisional Activities, which is a legally constituted part of ACS governance.

As the person who took the initiative to form the Division of Computers in Chemistry in 1974, I found that the mechanism for so doing was well defined and the pathway for carrying the petition through the process clearly marked.

As the person who has taken the initiative to promote a Materials Chemistry Secretariat, I have found a lack of understanding among the rank and file—and even among volunteer officers and staff—about just what a secretariat is and how it functions.

Our MCS steering committee has found there are many persons active in materials chemistry research who are enthusiastic about the concept of an ACS focus on materials chemistry and who see that transcending the interests of any single division. What is difficult to explain to them is why a bridging function such as a secretariat is constrained to an ad-hoc and ill-defined existence in ACS.

Given the increasing interest in secretariats—and the already large number of divisions and subdivisions in ACS—it seems to me we would be well advised to study the secretariat phenomenon and to consider whether or not the time has come to accord them full partnership in ACS.

Peter Lykos
Illinois Institute of Technology
Chicago

Trees getting even

SIR: Congratulations to the editor who did such a magnificent job of positioning the two articles on trees on opposing pages in your Sept. 19 issue—"Air pollution's damage to trees, crops detailed" on page 20, and "Trees contribute significantly to urban smog," page 21.

Clearly, the moral to be drawn is that the trees are trying to get even!

Jim Verdieck
Thousand Oaks, Calif.

Business and higher education

SIR: The comments of Arnold Weber (C&EN, Aug. 29, page 3) about the role of business in strengthening higher education are important and timely. Weber quite rightly addresses the need for scientists and nonscientists to be mutually and effectively educated in each others' broad areas. He notes in passing that business "should be as interested in the education of the English or economics major . . . as it is in the engineer."

This point cannot be overstated and indeed needs to be taken further. Although there is no question that the increasingly acute projected shortage of scientists and engineers in the U.S.—particularly among ethnic minorities—must be addressed in a meaningful way,

Chemical Earnings Continue Strong Gains in Third Quarter

William J. Storck,
C&EN Northeast News Bureau

Sometimes it seems that the economic recovery is just going to go on forever. And looking at another stellar performance in chemical earnings in the third quarter does nothing to make that feeling go away.

Once again, U.S. chemical companies turned in a banner performance for the period, with earnings rising about 65% from last year's third quarter. The strong earnings performance in chemicals also helped results for major oil and diversified companies that produce chemicals.

The only worrisome aspect is that some specialty companies that rely on commodity chemicals for feedstock are feeling a cost-price squeeze. For instance, Witco chairman William Wishnick states that, although the company was pleased with its record results, there had been a noticeable trend in the third quarter of continuing increased costs of raw materials, and only part of those increased costs had been passed on to customers. Witco's quarterly earnings increased 13% to $20 million on a sales rise of 9% to $403 million. Wishnick says the company will pass along the increased costs as market conditions warrant.

However, in the main, the story is getting to be a very familiar one. Strong demand, both domestic and export, for chemical products is causing tight supplies and therefore high capacity use. This is an ideal situation for rapidly rising earnings. The shortness of some chemical products allows for price increases that

Chemical industry leaders for the third quarter . . .

Sales

Rank 1988		$ Millions	Rank 1987
1	Dow Chemical	$4150.0	1
2	Union Carbide	2108.0	3
3	Monsanto	2022.0	2
4	W. R. Grace	1390.4	4
5	American Cyanamid	1094.1	5
6	Quantum Chemical	812.4	7
7	Arco Chemical	696.0	11
8	Hercules	686.9	6
9	B. F. Goodrich	640.4	10
10	Air Products	622.0	8

Earnings

	$ Millions	Rank 1987
Dow Chemical	$632.0	1
Union Carbide	213.0	3
Arco Chemical	126.0	4
Monsanto	116.0	2
Quantum Chemical	99.8	13
B. F. Goodrich	68.8	11
American Cyanamid	64.1	5
Ethyl	62.2	7
Georgia Gulf	53.1	12
W. R. Grace	50.6	8

Profitability

	Earnings as % of sales	Rank 1987
Georgia Gulf	19.0%	1
Arco Chemical	18.1	3
Vista Chemical	16.8	4
International Flavors	15.4	2
Dow Chemical	15.2	7
Aristech	15.0	11
Quantum Chemical	12.3	24
Ethyl	11.9	6
Loctite	11.2	8
Betz Laboratories	11.1	5

. . . and for first nine months of 1988

Sales

Rank 1987		$ Millions	Rank 1987
1	Dow Chemical	$12,383.0	1
2	Monsanto	6,412.0	2
3	Union Carbide	6,185.0	3
4	W. R. Grace	4,134.5	4
5	American Cyanamid	3,488.9	5
6	Quantum Chemical	2,379.8	7
7	Hercules	2,053.0	6
8	Arco Chemical	1,955.0	11
9	Rohm & Haas	1,940.4	8
10	Air Products	1,849.0	9

Earnings

	$ Millions	Rank 1987
Dow Chemical	$1775.0	1
Monsanto	546.0	2
Union Carbide	501.0	3
Arco Chemical	360.0	5
Quantum Chemical	285.4	11
American Cyanamid	242.8	4
Rohm & Haas	187.8	6
Ethyl	172.2	7
B. F. Goodrich	168.4	14
Air Products	158.4	8

Profitability

	Earnings as % of sales	Rank 1987
Georgia Gulf	27.4%	1
Aristech	19.0	14
Arco Chemical	18.4	3
Vista Chemical	16.1	11
International Flavors	16.0	2
Dow Chemical	14.3	9
Quantum Chemical	12.0	21
Ethyl	11.5	4
Betz Laboratories	10.8	5
Nalco Chemical	10.6	7

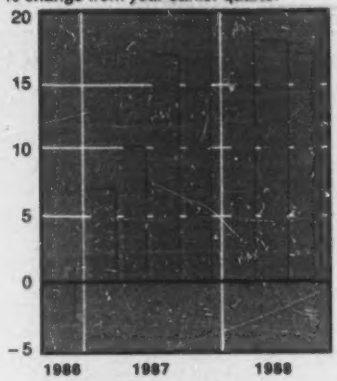
Note: For 30 chemical companies listed on page 26. a After taxes.

Chemical industry 1988 third-quarter results

- Sales were up 17%
- Earnings climbed 65%
- Profit margins at 9.7%
- Production rose 8.6%
- Prices soared 10%

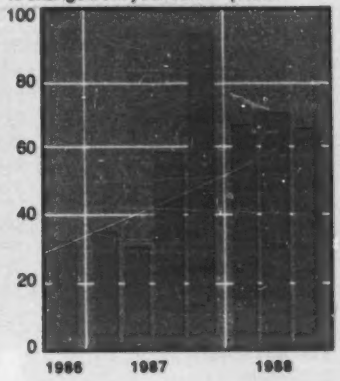
Sales

% change from year-earlier quarter



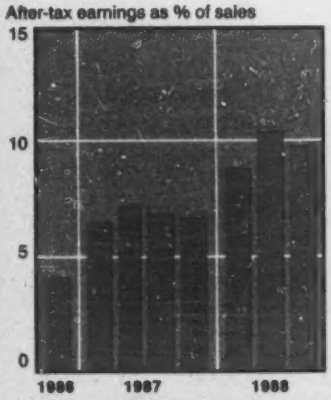
Earnings

% change from year-earlier quarter



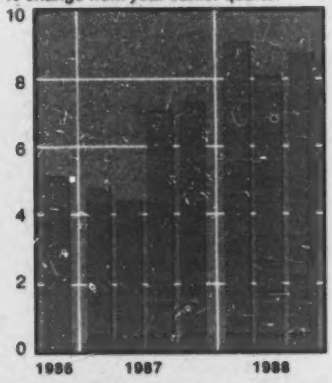
Profit margins

After-tax earnings as % of sales



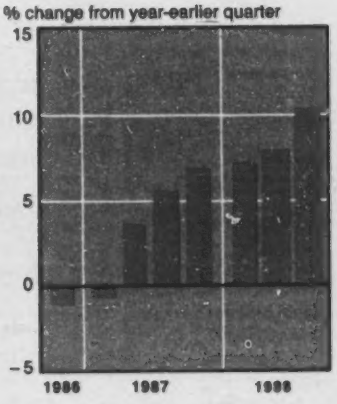
Production

% change from year-earlier quarter



Prices

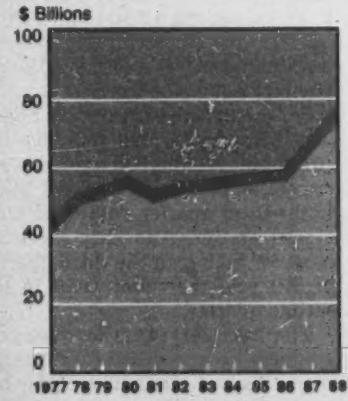
% change from year-earlier quarter



Sales in 1988 likely will climb about 17% while earnings will soar 65%, causing profits margins to move up to 9.5%

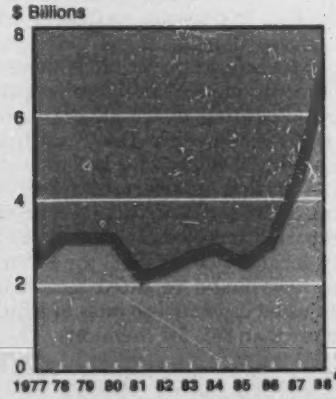
Annual sales

$ Billions



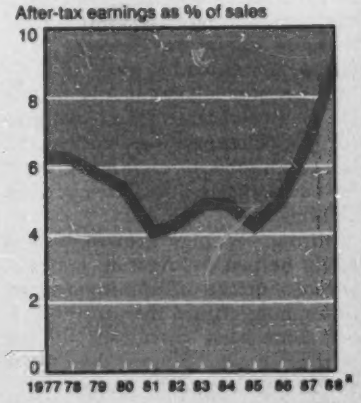
Annual earnings

$ Billions



Annual profit margins

After-tax earnings as % of sales



Note: All sales, earnings, and profit margin data are based on combined results of 30 companies listed on page 26. a C&EN estimates.

Third-quarter earnings for 30 major chemical firms soared 65% to $1.89 billion

	THIRD-QUARTER 1988						NINE-MONTHS 1988			
	Sales	Earnings[a]	Change from 1987		Profit margin[b]		Sales	Earnings[a]	Change from 1987	
	($ millions)		Sales	Earnings	1988	1987	($ millions)		Sales	Earnings
Air Products[c]	$ 622.0	$ 50.4	14%	29%	8.1%	7.2%	$ 1,849.0	$158.4	16%	31%
American Cyanamid[c]	1,094.1	64.1	5	17	5.9	5.3	3,486.9	242.8	11	19
Arco Chemical[c]	696.0	126.0	38	91	18.1	13.1	1,955.0	360.0	35	85
Aristech	278.0	41.6	16	122	15.0	7.8	806.7	153.3	19	217
Betz Laboratories	114.7	12.8	15	19	11.1	10.8	332.4	36.0	16	18
Cabot[c]	400.1	4.0	16	−47	1.0	2.2	1,289.8	39.0	30	−6
Chemed	146.7	6.6	45	9	4.5	6.0	354.5	17.2	22	10
Crompton & Knowles	90.4	3.9	54	48	4.4	4.5	232.4	12.6	30	45
Dow Chemical[c]	4,150.0	632.0	24	92	15.2	9.8	12,383.0	1775.0	27	99
Ethyl[c]	522.6	62.2	19	34	11.9	10.5	1,496.0	172.2	20	23
First Mississippi	81.9	4.5	4	−27	5.5	7.7	235.1	19.2	−2	6
H. B. Fuller	176.7	5.8	14	−26	3.3	5.1	504.1	16.3	14	−12
Georgia Gulf	278.7	53.1	58	90	19.0	15.8	508.8	139.2	37	146
B. F. Goodrich[c]	640.4	68.8	21	143	10.7	5.4	1,799.0	168.4	21	182
W. R. Grace[c]	1,390.4	50.6	26	24	3.6	3.7	4,134.5	147.5	29	66
Hercules[c]	686.9	32.2	5	−36	4.7	7.7	2,053.0	119.3	2	137
International Flavors	200.1	30.7	7	13	15.4	14.5	658.3	105.4	16	23
International Minerals	217.6	11.3	−49	−49	5.2	5.3	813.1	72.9	−39	68
Loctite	106.4	11.9	13	35	11.2	9.4	362.2	35.3	29	31
Lubrizol	263.9	24.7	13	31	9.4	8.1	841.6	79.5	9	16
Monsanto[c]	2,022.0	116.0	6	16	5.7	5.3	6,412.0	546.0	11	39
Nalco Chemical	248.8	26.9	15	32	10.8	9.4	732.2	77.9	20	34
Olin[c]	540.0	19.0	15	27	3.5	3.2	1,685.0	77.0	18	24
Pennwalt	243.2	7.7	18	31	3.2	2.8	760.1	35.0	20	32
Petrolite	71.7	2.5	5	−32	3.5	5.4	227.2	10.9	13	−8
Quantum Chemical[c]	812.4	99.8	33	262	12.3	4.5	2,379.8	285.4	30	264
Rohm & Haas[c]	619.8	49.8	15	27	8.0	7.3	1,940.4	187.8	16	18
Union Carbide[c]	2,108.0	213.0	22	188	10.1	4.3	6,185.0	501.0	22	140
Vista Chemical	197.6	33.2	19	84	16.8	10.9	599.5	96.6	25	142
Witco[c]	402.7	20.0	9	13	5.0	4.8	1,201.9	83.0	13	65
Total 15 larger companies	**$16,707.4**	**$1607.9**	**18%**	**72%**	**9.6%**	**6.6%**	**$50,252.3**	**$4882.8**	**20%**	**77%**
Total 15 smaller companies	**$ 2,716.4**	**$ 277.2**	**8%**	**35%**	**10.2%**	**8.2%**	**$ 7,968.2**	**$ 907.3**	**8%**	**63%**
GRAND TOTAL	**$19,423.8**	**$1885.1**	**17%**	**65%**	**9.7%**	**6.9%**	**$58,220.5**	**$5770.1**	**18%**	**75%**

a After-tax earnings from continuing operations, excluding significant extraordinary and nonrecurring items. b After-tax earnings as a percentage of sales. c One of the 15 larger companies.

in some cases are very high. And the high capacity utilization rates increase operating efficiencies at chemical companies, thus increasing earnings leverage. Add to this the relatively stable price conditions for petrochemical feedstocks, and the conditions for earnings growth far outpacing that for sales become obvious.

Strong earnings growth also is being helped by overseas markets, where shortage of supplies is sometimes more critical than in the U.S. For some basic chemicals, the export price can be more than twice the domestic price these days.

To meet the demand, production of chemicals and allied products in the third quarter rose almost 9% over the same period in 1987, according to government figures. The increase in output has pulled capacity utilization up considerably to more than 88% in the third quarter, according to the government's theoretical models. This is up from both the third quarter last year and the second quarter this year. In third-quarter 1987, the government reported capacity use at about 84%. In second-quarter 1988, the Federal Reserve Board reported seasonally adjusted capacity use rates of a little more than 86% for chemicals.

At the same time, prices have been increasing rapidly as supplies remain tight. The Labor Department's figures show that chemical prices in the third quarter were up more than 10% on a year-to-year basis. From the second quarter to the third quarter, prices, according to government data, increased 3.3% for chemicals and allied products.

For the narrower industrial chemicals category, which includes the commodity chemicals, prices increased an even more dramatic 14.5% in the third quarter, compared with a year earlier. And they were almost 5% higher in the third quarter of this year than they were in the second quarter.

The recovery in the chemical economy has proceeded long enough that corporate planners are now beginning to think that it is real. One indication is a spate of new plant announcements coming from chem-

NE-MONTHS 1988		12-MONTH RUNNING DATA			
Profit margin[b]		Change from 1987		Profit margin[b]	
1988	1987	Sales	Earnings	1988	1987
8.6%	7.6%	14%	34%	8.8%	7.5%
7.0	6.5	10	22	6.7	6.1
3.4	13.5	34	93	17.5	12.2
9.0	7.1	23	103	11.5	7.0
0.8	10.7	16	22	10.7	10.2
3.0	4.2	29	−8	3.3	4.7
4.9	5.4	18	13	4.8	5.0
5.4	4.8	25	45	5.4	4.6
4.3	9.1	26	101	13.3	8.4
1.5	11.2	20	21	11.4	11.3
8.2	7.5	6	25	6.9	5.9
3.2	4.2	13	−1	3.6	4.1
7.4	15.3	51	156	17.8	10.5
9.4	4.0	16	110	7.3	4.0
3.6	2.8	28	265	3.7	1.3
5.8	2.5	3	−18	6.2	7.8
3.0	15.1	18	23	15.1	14.4
9.0	3.2	−27	238	8.5	1.8
9.8	9.7	19	35	10.5	9.3
9.4	6.9	10	21	8.0	7.2
8.5	6.8	12	42	7.1	5.6
0.6	9.5	20	40	10.4	8.9
4.6	4.3	20	39	4.3	3.7
4.6	4.2	3	10	4.4	4.1
4.8	5.9	4	−5	4.8	5.8
2.0	4.3	32	225	11.2	4.6
9.7	9.5	16	15	9.1	9.1
3.1	4.1	20	135	6.5	3.3
8.1	8.4	28	151	15.7	8.0
3.9	4.7	13	24	5.1	4.7
9.7%	6.6%	18%	74%	8.6%	5.9%
1.4%	7.6%	20%	58%	11.2%	8.6%
9.9%	6.7%	18%	70%	9.0%	6.2%

ical companies that promise vastly increased capacity in some basic chemicals such as ethylene by the early 1990s. Companies also seem to have revised their short-term capital expenditures as well. A survey by the Commerce Department shows that capital spending for chemicals and allied products this year is expected to increase 12.5% over 1987 levels. A survey a few months earlier showed that capital spending for chemicals would rise a lesser 11.7% in 1988.

However, until those new plants come on stream early in the next decade, the supply situation for many commodity chemicals, and especially petrochemicals, likely will remain tight. However, this tightness will constrain growth in downstream polymers, such as polyethylene.

For the third quarter, almost everything was looking good. Demand was good for many inorganic commodity chemicals. And chemical company executives were praising demand in all areas of their businesses. However, in many respects, petrochemicals were the key. To determine how petrochemical performance added to the chemical earnings picture, it is best to look at the chemical operations of the oil companies, which are based largely on petrochemicals.

In the third quarter, combined earnings from chemical operations at six major oil firms—Amoco, Atlantic Richfield, Exxon, Mobil, Texaco, and Unocal—more than doubled, rising 131% from the comparable period last year to $923 million. This is even better than they had been doing. For the first nine months, combined earnings for these companies increased 106% to $2.54 billion. And this is without the results of Occidental Petroleum, which added Cain Chemical to its results in May, thus increasing its earnings in the third quarter 478% to $283 million and its nine-month results 138% to $622 million. This is, of course, without restating prior results to take into account the acquisition.

Other chemical products did not perform nearly so well as petrochemicals, however. Thus overall chemical company earnings were largely much lower than those recorded by just petrochemical operations at oil companies.

But, as a rule, they were good. Earnings for the 30 chemical companies regularly surveyed by C&EN rose 65% to a total of $1.89 billion. Sales increased 17% to a total of $19.4 billion. The average profit margin (earnings as a percentage of sales) increased to 9.7% from 6.9% in last year's third quarter, but dropped slightly from the second quarter's 10.3%.

In terms of growth, the larger firms on the list far outperformed the smaller companies, but they still lag in profitability, albeit slightly. Earnings for the 15 larger companies increased 72% to a combined $1.61 billion on a sales rise of 18% to $16.7 billion. The smaller 15 firms' earnings rose 35% to $277 million on a sales increase of just 8% to $2.72 billion. The smaller earnings rise may in part be due to the smaller firms' inability to cover rising raw material costs with price increases. It is also due in part to the inclusion of International Minerals & Chemical, which has spun off its fertilizer operations without restating past results. If IMC is excluded from the small company tally, earnings for the 14 remaining firms rose an average 45%—still well below the increase for the larger companies.

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For the first nine months, the situation is similar. For the 30 total companies, combined earnings increased 75% to $5.77 billion on a sales rise of 18% to $58.2 billion. Profit margins improved to 9.9% from 6.7% through the first three quarters of 1987. For the larger companies, earnings rose 77% to a total of $4.86 billion, and sales rose 20% to $50.3 billion. Profit margins for these firms averaged 9.7%, up from 6.6% in the first nine months last year.

For the smaller firms, earnings rose 63% through the first nine months to $907 million. But sales for these companies increased just 8% to $7.97 billion. Since the earnings increase was so much greater than that for sales, however, the profit margins growth was slightly stronger than for the larger firms, rising to 11.4% in the first nine months of this year from 7.6% in the comparable period of 1987.

For the third quarter, the best earnings increase was recorded by Quantum Chemical, which also is basically a petrochemicals producer. Quantum's earnings jumped 262% to $99.8 million on a sales gain of 33% to $812 million. Quantum chairman John Hoyt Stookey attributes the increase in sales and earnings from operations in the quarter principally to continued strong demand with generally higher selling prices and improved profit margins in the petrochemical business.

A bright spot for the quarter is that agricultural chemicals sales have begun to recover from the plunge caused by the farm recession and are showing few effects of the summer drought. Monsanto notes that its strong third-quarter results were

Earnings at pharmaceutical companies improve

Like their chemical brethren, pharmaceutical companies reported improved earnings in the third quarter, but unlike chemical companies, the increase was only modest and profit margins did not increase appreciably.

Third-quarter earnings for 12 major U.S. drug companies surveyed by C&EN increased 11% from last year's third quarter to $1.56 billion. The increase was only slightly higher than that for sales, which rose 10% to $11.7 billion. Consequently, the average profit margin for the group was 13.3%, essentially the same as the 13.2% margin in third-quarter 1987.

Previous quarters had been better this year, improving the results for the first nine months. During that period, earnings for the group rose 15% to a total of almost $4.70 billion, and sales increased 12% to an aggregate $34.7 billion. Thus, nine-month profit margins for the group rose to an average 13.6% from 13.2% in the first nine months of last year.

All but three of the companies reported earnings gains during the quarter. The biggest increase was at Merck, whose earnings climbed 31% to $312 million on a 12% sales increase to $1.47 billion. Merck's profit margin improved to 21.2% from 18.2% in last year's third quarter. Says Merck chairman P. Roy Vagelos: "Sales growth for the first nine months was led by new products. Strong unit volume gains were registered by both our domestic and international operations."

Another solid gainer was Schering-Plough, whose third-quarter earnings climbed 28% to $94.4 million on a 9% sales gain to $724 million. The company attributes stronger third-quarter performance to its worldwide pharmaceuticals business, sales of which rose 14%, and to continued growth by U.S. consumer businesses.

Upjohn's earnings grew 20% to $89.6 million on a 7% sales gain to $652 million. The company was helped by an above-average sales growth of 19% in its worldwide agricultural products business. Animal health products registered good sales gains in foreign markets. And the firm says that continued sales growth in the U.S. for Naxcel, its product for treatment of bovine respiratory disease introduced during the first quarter, was offset by decreases in sales of other animal health products. Upjohn claims excellent growth in domestic agronomic seed sales, and it says vegetable seed sales made excellent gains over the third quarter in 1987, particularly in Europe.

	THIRD-QUARTER 1988						NINE-MONTHS 1988					
	Sales ($ millions)	Earnings ($ millions)	Change from 1987 Sales	Change from 1987 Earnings	Profit margin 1988	Profit margin 1987	Sales ($ millions)	Earnings ($ millions)	Change from 1987 Sales	Change from 1987 Earnings	Profit margin 1988	Profit margin 1987
American Home Products	$1415.2	$240.7	9%	11%	17.0%	16.7%	$4199.6	$693.5	10%	10%	16.5%	16.5%
Baxter International	1708.0	85.0	6	−6	5.0	5.7	5036.0	267.0	10	15	5.3	5.1
Eli Lilly	940.6	171.4	11	19	18.2	17.0	3027.4	585.3	11	18	19.3	19.1
Merck	1468.8	311.8	12	31	21.2	18.2	4406.4	899.5	20	33	20.4	18.4
Pfizer	1382.9	216.8	7	17	15.7	14.3	4017.2	649.7	10	17	16.2	15.2
Rorer Group	244.5	15.2	9	12	6.2	6.0	716.4	34.9	11	10	4.9	4.9
Schering-Plough	724.4	94.4	9	28	13.0	11.1	2229.5	296.9	10	23	13.3	11.8
SmithKline Beckman	1172.7	97.1	6	−35	8.3	13.6	3472.1	362.4	11	−15	10.4	13.7
Squibb	579.5	123.0	21	13	18.1	19.5	1921.0	328.0	28	20	17.1	17.5
A. H. Robins	264.1	23.4	16	−12	8.9	11.6	692.8	45.5	12	−25	6.6	9.7
Upjohn	651.8	89.6	7	20	13.7	12.3	2035.8	272.8	9	17	13.4	12.5
Warner Lambert	1081.4	87.7	16	16	8.5	8.5	2910.5	262.8	14	14	9.0	9.0

Earnings increase for oil and diversified companies

	THIRD-QUARTER 1988						NINE-MONTHS 1988					
	Sales ($ millions)	Earnings[a] ($ millions)	Change from 1987 Sales	Change from 1987 Earnings	Profit margin[b] 1988	Profit margin[b] 1987	Sales ($ millions)	Earnings[a] ($ millions)	Change from 1987 Sales	Change from 1987 Earnings	Profit margin[b] 1988	Profit margin[b] 1987
OIL AND GAS COMPANIES												
American Petrofina	$ 696.1	$ 67.2	5%	217%	9.6%	3.2%	$ 1,959.2	$ 132.0	8%	89%	6.7%	3.8%
Amoco	5,948.0	552.0	3	34	9.3	7.2	17,878.0	1688.0	7	72	9.4	5.9
Ashland	2,098.6	66.2	5	1	3.2	3.3	6,108.0	143.7	13	35	2.4	2.0
Atlantic Richfield	4,592.0	391.0	3	24	8.5	7.1	13,776.0	1192.0	12	35	8.7	7.2
Chevron	7,200.0	420.0	−6	41	5.8	3.9	22,000.0	1593.0	1	57	7.2	4.7
Exxon	21,888.0	1225.0	0	15	5.6	4.9	65,522.0	3880.0	6	18	5.9	5.3
Kerr-McGee	659.9	30.5	−5	40	4.6	3.1	2,053.6	76.6	4	11	3.7	3.5
Mobil	13,116.0	557.0	0	69	4.2	2.5	40,987.0	1590.0	10	92	3.9	2.2
Occidental Petroleum	4,913.0	108.0	16	135	2.2	1.1	14,133.0	306.0	11	90	2.2	1.3
Phillips Petroleum	2,850.0	215.0	2	594	7.5	1.1	8,630.0	515.0	8	25,650	6.0	0
Sun Co.	2,460.0	72.0	−2	−47	2.9	5.4	7,280.0	228.0	1	−14	3.1	3.7
Texaco	8,689.0	239.0	−3	121	2.8	1.2	26,799.0	707.0	3	111	2.6	1.3
Unocal	2,581.0	97.0	0	234	3.8	1.1	7,432.0	224.0	5	47	3.0	2.2
DIVERSIFIED MANUFACTURERS												
Allied-Signal	2,864.0	119.0	7	29	4.2	3.4	8,902.0	367.0	9	17	4.1	3.8
Borden	1,874.2	91.9	12	16	4.9	4.7	5,260.2	218.0	12	17	4.1	3.9
Du Pont	7,985.0	461.0	5	2	5.8	6.0	24,476.0	1690.0	9	25	6.9	6.0
Eastman Kodak	5,029.0	435.0	28	10	8.6	10.1	12,491.0	679.0	28	−5	5.4	7.3
Engelhard	614.4	16.9	0	15	2.8	2.4	1,655.6	44.5	−5	−4	2.7	2.8
FMC	798.2	31.2	9	16	3.9	3.7	2,404.8	93.2	5	2	3.9	4.0
Ferro Corp.	247.7	11.8	15	42	4.8	3.9	748.2	34.9	17	56	4.7	3.5
3M	2,689.0	296.0	9	19	11.0	10.1	8,002.0	882.0	13	26	11.0	10.0
Morton-Thiokol	501.5	41.3	19	2	8.9	8.1	1,829.1	120.8	16	7	6.6	7.2
PPG Industries	1,361.0	112.9	8	24	8.3	7.2	4,185.0	365.3	9	30	8.7	7.3
Vulcan Materials	298.6	49.4	11	6	16.5	17.2	785.7	110.9	16	17	14.1	14.0
Tyler	172.8	3.8	8	−50	2.2	4.6	496.9	13.8	6	−22	2.8	3.8

a From continuing operations excluding major nonrecurring and extraordinary items. b Earnings as a percentage of sales.

led by Monsanto Agricultural Co. as well as Monsanto Chemical Co., both operating units of the corporation. The agricultural businesses were buoyed by sales of Roundup herbicide and Alimet poultry feed supplement.

Overall, for the three-month period, Monsanto's earnings from crop chemicals increased 17% to $82 million, while sales increased 12% to $307 million. Crop chemicals make up about 43% of Monsanto's operating income, but just 15% of its sales.

Pesticides have begun a financial comeback at Rohm & Haas, although physical volume of agricultural chemicals sales in the third quarter were off 3% from the same period a year earlier, indicating stronger selling prices. Sales of agricultural chemicals in the quarter were up 14% to $59.7 million and net earnings from those operations moved from a loss of $1.3 million to a slight gain of $100,000.

American Cyanamid does not break out operating results for its agricultural chemicals, but did note in an announcement, "Athough the major portion of the selling cycle for the agricultural group occurs in the first six months of the year, worldwide sales of the group were higher in the third quarter than in the comparable period last year; and, as a consequence, operating results improved."

Most companies see the strong performance carrying through the remainder of the year. Dow Chemical's financial vice president Enrique C. Falla says, "The strong fundamentals and momentum are strong, positioning the industry and Dow for a strong fourth-quarter performance. Dow has already recorded net earnings per share of $9.32 year-to-date, which is 44% higher than the $6.47 set for all of 1987. Obviously, 1988 is a record year for Dow."

Union Carbide chairman Robert D. Kennedy says the strong performance reflects the upswing for chemicals generally and also attributes some of the performance to the company's position in some markets and low-cost manufacturing in key product areas. He says that he expects fourth-quarter earnings to be about the same as or slightly higher than those in the third quarter.

And Aristech chairman Thomas Marshall says with the current strength in both the domestic and export markets and Aristech's increased capacity on stream, the prospect is for an outstanding performance for the full year of 1988. □

Many University Research Facilities Need Repairs

National Science Foundation survey finds that more schools are deferring lab construction because they can't secure funding for renovation

In the first, full-scale survey of its kind, the National Science Foundation has discovered that nearly 60% of space currently used for academic research is in need of repair. And, because of problems in securing funding for renovation, the survey finds that universities and colleges are deferring more and more lab construction as time goes on.

The NSF study on scientific and engineering research facilities was mandated by Congress in 1986. To be done every other year, the study is a response to increasing pleas from academic institutions for more federal funding to keep laboratories up-to-date and functioning. Although a quick-response survey of research institutions was done by NSF in 1986, the 1988 survey is its first complete study.

One of the things NSF determined is that there are about 114 million sq ft of research space at U.S. academic institutions. Nearly all of this space is at doctorate-granting universities, and NSF says that the top 50 R&D universities account for 50% of all the research space. Nearly 80% of the research space is taken up by five science and engineering fields: biology, medicine, agriculture, physical science, and engineering. These five disciplines also account for about 80% of total academic R&D expenditures.

According to responses received from the survey, only about one fourth of the space currently used for research is suitable for the most sophisticated research in its field. Almost 40% of research space is in need of limited or major repair to be used effectively. Consequently, the survey found that institutions plan to spend about $777 million in 1988 and 1989 for repairs and renovation of lab space. This represents work on only 9% of lab space, meaning that only a small portion of the labs needing repair will be worked on.

In fact, the survey found that one of the most common themes mentioned by academic officials is the backlog of necessary repairs and renovations. They say that there is continued deferral of repairs and that this is compromising the quality of the research space. NSF reports that total expenditures for repairs, on a square footage basis, are declining, indicating that the level of deferred renovations is increasing over time.

Institutions reported they expect to spend nearly $3.4 billion on construction of new facilities. Responses to the survey indicate that this increased building of labs is caused more by rapidly changing technical and regulatory requirements than by the institutions' desire to expand their research space. One of the areas often cited is the extremely high cost of building animal research facilities under today's federal regulations.

According to NSF, renovation backlogs and the need for more research space were cited about one third of the time as causing problems to the university's or college's research program. Physical science administrators in particular mentioned that the lack of excellent facilities can hurt in recruiting top faculty and graduate students to a program. Lack of facilities also limits the numbers and types of research projects that can be undertaken. In some instances, universities are losing qualified researchers because of inadequate lab space.

Universities have to rely on a variety of sources for money to spend on renovations and new construction. NSF reports that public institutions get their largest percentage of funds from state and local governments. These sources will provide a little more than $1 billion over the next two years. Private schools rely mostly on private donations and on tax-exempt bonds, from which more than $300 million

Universities received most of their lab funds from state and local governments in 1986 and 1987

$ Millions	Construction		Repair/renovation	
	Public	Private	Public	Private
Federal government	$ 41.0	$106.7	$ 13.2	$ 14.4
State and local government	757.8	25.1	227.9	6.7
Private	259.9	227.6	15.0	90.9
Institutional funds	110.1	181.2	156.3	174.2
Tax-exempt bonds	192.8	124.5	25.8	126.8
Other debt	2.4	0.7	0.3	3.7
Other sources	0.2	33.0	0.2	7.5
TOTAL	$1304.2	$698.7	$438.8	$424.1

Note: Totals may not add because of rounding. Source: National Science Foundation

will be raised for new construction in the same time period. The proportion of federal support for these institutions is just 7% of the total for construction and less than 5% for repair, or about $227 million for everything.

One major change in recent years has been the federally imposed limit on funds that a university can raise with tax-exempt bonds. The 1986 tax reform bill put a ceiling of $150 million on outstanding tax-exempt bonds for each institution. NSF reports that at the time of its survey, 10% of the private research-performing institutions had already reached that cap, and another 4% were expected to top out within the next two years. Among the private schools, 20% had already reached the $150 million limit.

NSF did not analyze the impact on universities of not being able to finance construction or renovation through such debt tools, but it is easy to see that without the bonds, schools will have to rely more on government support (which may be decreasing) or on donations from individuals. Another option would be to increase efforts to get Congress to support construction programs for individual projects outside the normal funding mechanisms, the so-called pork-barrel science method (C&EN, July 18, page 7).

Copies of the NSF report, titled "Scientific & Engineering Research Facilities and Universities & Colleges: 1988," can be obtained from the Division of Science Resources Studies, National Science Foundation, 1800 G St., N.W., Room L-602, Washington, D.C. 20550. The publication number is NSF 88-320.

David Hanson

Institute eyed to train biotech patent examiners

A series of meetings is now under way between the Patent & Trademark Office and the Industrial Biotechnology Association that may culminate next March with the formation of a new Biotechnology Institute. The institute would provide formal technical and legal education programs for PTO's Group 180 (biotechnology) patent examiners.

IBA approached PTO with the idea for setting up the institute this past summer because it was concerned about the current backlog of 6500 biotechnology applications and about the five months longer, on average, that it takes to get a biotechnology application through the patent approval process than it does other applications.

IBA president Richard D. Godown explains that without patent protection "the biotechnology industry cannot compete or maintain its competitive position in international arenas. . . . Biotechnology doesn't want to be kept out of the race because there aren't enough qualified, well-trained patent examiners." PTO was receptive to the idea, in part because, as a spokesman said, it's always helpful to have outside experts bring in fresh ideas and provide new input to the examiners.

According to Godown, the institute would be under the control of the patent office but would be able to draw upon the expertise not only of IBA member companies but also the patent bar and academic and government experts in the field of biotechnology for help in educating the Group 180 examiners. This assistance could include, among other things, daylong training seminars for new examiners and continuing education programs for examiners already on the PTO staff. IBA also would assist the patent office in updating its library of biotechnology publications and facilitating visits by Group 180 examiners to biotechnology companies.

Godown says he really doesn't know how much the institute would cost, but he expects that industry would share part of the costs, since it is permissible for PTO to accept outside donations to its examiners training fund. And there will be quite a few examiners to train. PTO started the year with 75 biotechnology examiners and expects to have hired 36 more by the end of the year. It intends to add an additional 20 by fiscal 1990, which as Godown puts it, is "a nice increase."

Janice Long

Federal Alert—new regulations

This C&EN listing highlights regulations published in the Federal Register *from Aug. 1 to Oct. 31. Complete information is available on the page numbers cited.*

PROPOSED

Environmental Protection Agency—Establishes worker protection standards for employees cleaning up hazardous waste sites under Superfund; comments by Nov. 16 (Oct. 17, page 40692).

Sets procedures for changing rules on permitting pesticide residues on processed foods, including policy on Delaney Clause paradox; comments by Dec. 19 (Oct. 19, page 41126).

Occupational Safety & Health Administration—Seeks comments on feasibility and usefulness of generic standards on exposure monitoring for toxic substances; comments by Dec. 27 (Sept. 27, page 37591).

FINAL

Commerce Department—Makes numerous changes to list of export-controlled products, including minerals, chemicals, and petroleum products; effective Sept. 14 (Sept. 14, page 35459).

Environmental Protection Agency—Freezes production and consumption levels of certain chlorofluorocarbons and brominated compounds to limit stratospheric ozone depletion; effective with onset of Montreal protocol (Aug. 12, page 30566).

Requires producers of pesticide active ingredients to register their production establishments and submit annual production reports; effective after 60 Congressional working days (Sept. 6, page 35056).

Finalizes revisions to general pretreatment regulations for discharges into publicly owned water treatment facilities; effective Nov. 16 (Oct. 17, page 40662).

Promulgates financial responsibility requirements for owners and operators of underground storage tanks containing petroleum; effective Jan. 24, 1988 (Oct. 26, page 43322).

Nuclear Regulatory Commission—Provides for licensing of storage of spent nuclear fuel and high-level radioactive wastes at monitored retrievable facilities; effective Sept. 19 (Aug. 19, page 31651).

Occupational Safety & Health Administration—Delays effective date of standard for exposure to formaldehyde for all laboratories except anatomy, histology, and pathology labs; effective Jan. 1, 1989 (Sept. 1, page 33807).

Requires that union representatives must show health causes to get permission to see employee medical records, makes other changes to health records access rule; effective Nov. 28 (Sept. 29, page 38140).